. . . THE . . .

MONTHLY REVIEW

Published by the

American Electro-Platers Society

KRESGE-HOOKER
WAYNE
UNIVERSITY
SCIENCE LIBRARY

A SOCIETY FOR THE ADVANCEMENT
OF THE
SCIENCE OF ELECTRO-PLATING

v.7#4

APRIL, 1920

Entered as second-class matter, March 1, 1917, at the Post Office at St. Louis, Mo., under the Act of August 24, 1912

Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized August 12, 1918

Copyright, by American Electro-platers' Society

This book is the property of the members of the American Electro-Platers' Society. Papers printed herein are released after 10 days, except when rights are reserved.

EXECUTIVE BOARD, A. E. S., 1919-1920.

PRESIDENT.

Oscar E. Servis, 5305 Warner Avenue, Chicago, Illinois.

FIRST VICE-PRESIDENT.

Sylvester P. Gartland, 128 Bryan St., Rochester, N. Y.

SECOND VICE-PRESIDENT.

Philip W. Uhl, 2432 N. 29th St., Philadelphia, Pa.

SECRETARY-TREASURER.

J. E. Sterling, 473 Tenth Ave., Long Island City, N. Y.

PAST PRESIDENT.

Walter Fraine, 507 Grand Avenue, Dayton, Ohio.

EDITOR.

H. H. Williams, 4156 Botanical Avenue, St. Louis, Mo.

ASSOCIATE EDITORS.

Dr. W. Blum, Bureau of Standards, Washington, D. C.
F. Mesle, Sherrill, N. Y.

INDEX

New York Number—Work of the New York Branch..... 3
Magic Fluid vs. Faraday's Law..... 4
The Deposition of Nickel and Cadmium with Silver from Silver Cyanide Solutions 5
Determination of Gold and Silver in Cyanide Solution..... 9
Electro Deposition of Bright Nickel..... 9
Alkali Copper Solution 13
Electro Deposition of Copper Upon Wax..... 15
Preliminary Announcement 17
What the Branches Are Doing..... 19
News Items 24

If I live a life that is clean and square,
And I love my fellow man,
And I lend him a hand to help him bear
His burden whenever I can;
I need not fear what the future holds,
Nor what the reward shall be,
For the mighty love that all enfolds
Will most surely care for me.

MONTHLY REVIEW

Published by the

American Electro-Platers' Society

Editors' Office, 4156 Botanical Ave., St. Louis, Mo.

Vol. 7 APRIL No. 4

NEW YORK NUMBER

of the "Monthly Review" is now before you. On account of limited space, some material has been held over. We congratulate New York Branch on the result of the afternoon session, previous to banquet, and they can feel proud of this number. They have reserved the privilege of further publication of these papers.

WORK OF THE NEW YORK BRANCH

By Joseph Haas, Jr.

It becomes especially fitting on an occasion such as this, to give an account of the work that the New York Branch is doing and is planning to do through its laboratory, and what it does at its regular meetings. A laboratory meeting is held on every Tuesday night. These meetings have nothing to do with regular meetings held on every second and fourth Friday of the month, but are absolutely distinct. It is a meeting to which a member may come and work on some problem of his own, or he can work in conjunction with others. The advantage of such opportunities are great, especially to those that are so situated at their place of employment that they have no time to try out the practicability of something they may have heard or read.

The laboratory of the New York Branch is so thoroughly equipped that complete chemical analysis may be carried out, or any plating solution made up and operated. At present, some are working up a board of finishes. This board is to be supplemented with a card index system, to enable others to find out all operation and solutions used in producing them. Some, on the other hand, are analyzing solutions by the Assay Gallon Method.

The following are some of the problems that are to be worked on in the future:

1. Investigation of the relation between the density of a nickel solution and pitting.
2. The analysis of various plating salts and polishing compounds.
3. Deposition of cadmium.
4. Deposition of nickel-silver alloy.
5. Electro-plating engineering, or planning "plants" out on paper.
6. Series of experiments to acquaint members more thoroughly about the construction and advantages of various dynamos, and the use of electrical instruments.
7. Practical methods of determining the conductivity of various plating solutions and so-called conducting salts.

8. To list and display in our meeting-room, the various salts used by platers, and simple tests for their detection. At our regular meetings, after business has been transacted, under "Good and Welfare," papers are read and plating problems discussed. It is here, in discussion and with the opinions of the various members, that untold advantages are to be gained. It can be positively stated, that there is no member that at sometime or other has not left a meeting with a little more knowledge under his hat, than when he came there.

It has been in the past the policy of the New York Branch not to solicit for members. It still retains that policy, in that it will not accept every applicant, unless he can fully meet the requirements for membership. But having the welfare of the electro-plating industry at heart, the New York Branch does today ask those who are not members to consider becoming members, if they can fulfill the requirements.

*All rights reserved by New York Branch.

MAGIC FLUID, VS. FARADAY'S LAW

Well, the first shot fired at Magic Fluid came from Chicago. The same old story: "It can't be done." Faraday's law says so. I am surprised, we also have Faraday's law in our school books here in Detroit and have considerable respect for the old Gent, even if he is a back number; and we don't like the idea of putting his law on the "Footsenheimer," but are quite confident that if he were alive today, he would be willing to accept mild reservations; if not a repeal.

History repeats itself: Tesla, Marconi, Edison, John Satka, and other great men and pioneers in science and invention, were told: "It can't be done," but they went ahead and did it; and so do we. We don't shelter ourselves under Faraday's law. We may start, but when we are forced to cut loose, we do it and get results.

Our critic shows a lack of understanding of the spirit of "Dynamic Detroit" if he imagines we allow any human law to cramp our production. Please note, the new creation is not called Faraday's Fluid; we modestly cut the personal element out at the christening out of respect to Mr. Faraday and ourselves.

If Sir Oliver Lodge could page Mike Faraday he can inform him that we use his law mostly for advertising purposes, so people will know that we are not ignorant of it.

According to Faraday's law; 1 Amp. will deposit 1.09 grams of nickel in 1 hour; 50 Amps. will deposit 54.5 grams per hour then—54.5÷12=4.54 grams in 5 minutes. 4.54÷28.34 (grams per oz. = .16 oz. of nickel deposited in 5 minutes. Now we have deposited on a lamp door with 50 Amps., from .28 to .35 oz. of nickel in 5 minutes and are doing it right along, we are depositing from .25 to 35 oz. of copper in 8 minutes. In the words of the immortal "Pershing": "We are there, 'Lafayette.'"

E. G. LOVERING.

NOTE—This is not a "Fluo Borate Nickel," as Mr. Phillips, of the Inland Motor Products Co., Detroit, is working a sol. without any boric acid in solution and getting excellent results.—E. G. L.

THE DEPOSITION OF NICKEL AND CADMIUM WITH SILVER FROM SILVER CYANIDE SOLUTIONS*

By M. E. Stewart

The possibility of the deposition of other metals with silver always becomes of general interest during periods of high silver prices. Such a period is now with us.

Some manufacturers are now using nickel in their silver solutions and are apparently satisfied with the results obtained. However, it is soon noticed that there is no uniformity in the results claimed by the use of nickel. General information regarding the exact quantity of nickel possible to plate out with silver in the silver cyanide solution is apparently lacking.

This series of experiments was originally started to determine approximately how much nickel could be expected to deposit with silver under various conditions. We first made up a preliminary solution with the following composition:

Water.	1 gallon
Sodium Cyanide	5 ounces
Silver Cyanide	3 ounces
Nickel Cyanide	1 ounce

This solution was run at room temperature. Anode and cathode surface was equal. (Three square inches.) Anode area, ⅔ silver and ⅓ nickel. Distance between anode and cathode, 3 inches. Time of deposit one-half hour.

The results were as follows:

No. Piece.	Volts.	% Ni.	Character Deposit.
1	½	none	Smooth Adherent
2	1	.22	"
3	1½	.38	"
4	2	.40	Adherent
5	2½	.27	Rough Loose
6	3	.35	" "

At over two volts pressure, the deposit was so rough that it would not be acceptable commercially. These deposits were made on zinc in order that the silver nickel deposit could be readily stripped from the base metal and analyzed. The results obtained here so evidently contradicted the claims of some manufacturers that 20 to 25% nickel could be obtained, that we now made up a straight nickel cyanide solution with the following formula:

Water.	1 gallon
Nickel Cyanide	3 ounces
Sodium Cyanide	3½ ounces

Anodes of pure sheet nickel and cathodes of sheet brass were cut the size (1½"x3") and weighed. A run was now made from this solution with the following results:

		Wt. Anode			Wt. Cathode		
No.	Volts.	Before Plating.	After Plating.	Loss.	Before Plating.	After Plating.	Gain or Loss.
1	½	12.436 Gr.	12.430	.006	11.584	11.580	-.004
2	1	12.388 Gr.	12.382	.006	12.726	12.725	-.001
3	1½	12.615 Gr.	12.614	.001	12.973	12.971	-.002

*All rights reserved by New York Branch.

4	2	12.372 Gr.	12.354	.016	12.594	12.592	-.002
5	2½	12.492 Gr.	12.472	.020	13.040	13.039	-.001
6	3	12.100 Gr.	12.004	.096	12.016	12.015	-.001
7	4	11.811 Gr.	11.482	.329	12.845	12.844	-.001
8	6	12.854 Gr.	11.829	.925	13.248	13.258	x.010
9	9	11.791 Gr.	10.544	1.247	13.121	13.125	x.004

The solution was run at 14° C. Anode and cathode surface equal. Distance between anode and cathode, 3". Time of deposit, one-half hour. From ½ to 1½ volts, it was noticed that the anode was slightly pitted, but no other action was noticed. From 1½ volts on, greenish specks appeared on the anode, and as the voltage was raised, the green coating (probably nickel hydroxide) spread over the entire anode, and as will be seen from the weights, some nickel went into solution. No nickel was observed on the brass cathode until 6 volts were reached. At this point, a very slight coating of nickel was seen on the edge of the anode. At 9 volts, it looked as if slightly more was deposited, although the weight shows less. In any case, the deposit was not heavy enough to be of any value. It is evident that under the conditions prevailing in this experiment, nickel cannot be deposited from a cyanide solution commercially. From this it appears that the small amount of nickel deposited with the silver from the silver nickel solution, was taken over more or less mechanically with the silver.

However, we did not wish to let the matter rest here, and obtained samples of a silver solution used by a manufacturer depositing nickel with his silver, as well as a sample of the deposit obtained by him. It was found that the deposit contained approximately 5% nickel. The solution analyzed as follows:

Water.	1	gallon
Sodium Cyanide	6	ounces
Silver Cyanide	1.5	ounces
Nickel Cyanide	4.4	ounces
Sodium Carbonate	5.4	ounces

In other words, there was about three times as much nickel as silver in the solution and only 5% of nickel was obtained in the deposit. We now made up various silver nickel solutions with different concentrations, different proportions of nickel and silver at the anode, different proportions of nickel and silver in the solution and ran them at different voltages with the following results:

No.	Ozs. per. Gallon Sod Cy	Sil Cy	NiCy	Soda Ash	% Ni in Deposit	Volts	C. D. in Amp per sq. ft.	Temp C	Anode Area Prop Sil	Ni	Time Run Hour
1	6	1.5	4.4	5.4	.74	1.4	4.4	11	½	½	3
2	3.5	1.5	2	3	.98	1.5	4.2	12	½	½	3
3	3	2	1	3	.40	1.5	4.3	11	½	½	3
4	6	1.5	4.4	...	1.02	1.5	4.0	12	½	½	3
5	2.6	.7	1.8	...	1.27	1.5	3.4	12	½	½	3
6	2.9	1.45	.8	...	.32	1.5	4.0	11	¼	¾	3
7	2.4	1.14	1.55	...	.50	1	1.3	10	½	½	4
8	6	1.5	4.4	5.4	1.00	1	1.6	10	½	½	4

Distance between anode and cathode, 3".

Volume of solution used, 300 c.c

Anode and cathode area equal.

It will be noted immediately that the amount of nickel deposited is very erratic, varying from .32 to 1.27%. The only general conclusion that may be drawn is that under the conditions prevailing in the above experiments there must be considerable more nickel than silver in solution in order to obtain a deposit containing as much as 1% nickel. It will also be noticed that there is practically no control of the amount of nickel deposited from similar solutions. Solutions Nos. 1 and 8 have the same composition, the only difference being that No. 1 was run at 1½ volts and No. 8 at 1 volt. Yet the deposit from No. 8 ran 1% nickel and in No. 1 only .74% nickel. Solution No. 5 has approximately one-half the strength of Solution No. 1, both were run at the same voltage, yet the weaker solution deposited 1.27% nickel and the higher only .74%. Solutions Nos. 3 and 6 are not radically different in composition. In Solution No. 6 the anode surface was changed from one-half nickel and one-half silver to one-quarter silver and three-quarter nickel. Yet the deposit with No. 3 ran .4% and only .32% in No. 6.

The results of this experiment again shows that under our conditions the amount of nickel deposited cannot be readily controlled, as it is apparently simply carried over mechanically by the silver. Some nickel, however, is taken into solution from the anodes. Most of this nickel simply stays in the solution and builds up its nickel content. It would seem further that the deposition of 5% nickel is the exception rather than the rule, as with various types of solution we only obtained a deposit containing 1.27% nickel.

As nickel is apparently not the material to use for those whose object is the deposition of fairly large percentages with silver, we now tried out cadmium. In these experiments cadmium trisalyt was used. This material runs 20% metallic cadmium. The following table gives the results obtained:

No.	Oz. per Gallon Sod Sy Cy	Sil Sy Cy	Cad Tris	Prop Sil to Cad in Sol	% Cad in Deposit	Volts	C. D. in Amp Per Sq. ft.	Temp in °C	Anode Area Separate Anodes Sil	Cad	% Cad & Sil in Cast Anode Sil	Cad	Time Run in Hours
9	1	½	6	1-3	52.1	1½	6 00	12	½	½	....	....	2
10	1	1	4	1-1	36.6	1½	5.60	11	½	½	....	....	2
11	2	2	4	2-1	25.5	1½	7.80	12	½	½	....	....	2
12	3	3	2	6-1	8.8	1½	8.00	12	½	½	....	....	2
13	2	2	4	2-1	1.7	¾	1.75	12	½	½	....	....	4
14	2	2	4	2-1	18.1	1¼	3.00	11	½	½	....	....	3
15	2	2	4	2-1	24	1½	5.0	12	½	½	....	....	2
16	2	2	4	2-1	8.5	1¼	3.2	6	..	..	98.9	1.1	3
17	2	2	4	2-1	19.2	1¼	2.8	6	..	..	74.6	25.4	3

Distance between anode and cathode, 3".

Total volume of solution used, 300 c.c.

Anode and cathode area equal.

The above experiments can be divided into three divisions. Solutions Nos. 9 to 12 were made up with silver and cadmium proportions ranging from 1 part silver and 3 parts cadmium in Solution No. 9, to 6 parts silver and 1 part cadmium in Solution No. 12. It

will be noticed that although the anode surface (½ silver and ½ cadmium) in all this group of experiments were the same, the percentage of cadmium in the deposit is influenced very largely by the proportions of cadmium in the solution. The results ranging from the deposit containing 52.1% cadmium to one containing 8.8%.

The next group, Nos. 13 to 15, show the effect of different voltages on similar solutions and under similar conditions. At ¾ of a volt only 1.7% cadmium was obtained. At 1¼ volt the cadmium content jumped to 18%, and at 1½ volts to 24%. Higher voltages were tried, but the resulting deposit were purely granular, and the experiments were not continued. From this it would appear that at least one volt is necessary to obtain a deposit containing appreciable quantities of cadmium.

Our next experiments, Nos. 16 and 17, were run for the purpose of trying out the effect of different proportions of silver and cadmium in the anodes. Some difficulty was encountered in casting the anodes, due to the large difference in melting points between the silver and cadmium. Some of the cadmium was lost before the melt could be completed. The first anode contained only 1.1% cadmium and without doubt the same results could be obtained in a solution with a straight silver anode. Our next anode contained 25% cadmium and the cadmium deposit jumped from 8.5% to 19.2%, showing that the percentage of cadmium in the anode has an appreciable effect on the amount of cadmium deposited No great difference was observed between the deposits already obtained from solutions in which the cadmium was cast with the silver as anode and those in which the cadmium and silver were hung in separately. In all experiments at 1¼ volts and under the deposit obtained was of good color. At over this voltage the deposits were spongy.

Conclusion

No appreciable quantity of nickel can be deposited with silver from a cyanide solution under ordinary conditions. What nickel is deposited is apparently carried over mechanically by the silver.

High percentages of cadmium can be deposited with silver from a cyanide solution. The percentage of cadmium in the deposit depends mainly on the amount of cadmium in the solution. Although the proportions of cadmium and nickel used as anodes also has a decided effect. Little cadmium is deposited at under 1 volt pressure.

We believe that with proper care a silver cadmium deposit can be obtained at a considerably lower cost than straight silver that would answer satisfactorily many purposes for which silver alone is used today.

HOW IT HAPPENED

Teacher—Freddie, you must not laugh out loud like that in the school room.

Freddy—I didn't mean to do it. I was smiling when all of a sudden the smile busted.

DETERMINATION OF GOLD AND SILVER IN CYANIDE SOLUTION*

By C. G. Piske

For Gold

Measure out accurately with a troy assay gallon pipette attached to a long rubber tube, to prevent its being drawn into the mouth, 12.17 c.c. of the gold cyanide solution which is to be examined. Place into a 400 c.c. beaker and add 20 c.c. of C. P. hydrochloric acid (HCl), place on a hot plate and evaporate to dryness; cool, then add 10 c.c. of HCl and 10 of H_2O. Place watch crystal on beaker and boil. Add 200 c.c. H_2O (Note—If there is any silver in the gold solution it will show at this stage and should be filtered out.) Next add one-half a gram of hydroxylamine sulphate, boil until solution is completely reduced or until it is colorless; filter precipitated gold on an ashless filter paper, wash with hot H_2O, transfer to a porcelain crucible, ignite over a bunsen burner until all carbonaceous material is burned off. Cool carefully, transfer to scale pan, brushing out any particles adhering to crucible with a fine camel's hair brush, and weigh carefully.

Calculation

One Assay Gallon Taken—

Number of decigrams found X 20
will equal dwts. of gold per gallon.

For Silver—

Measure out one troy assay gallon of the silver cyanide solution which is to be examined into a 400 c.c. beaker, add 20 c.c. of concentrated C. P. hydrochloric acid, place beaker on a hot plate, cover with a watch crystal and boil until white precipitate of silver chloride (AgCl) settles out; now add 200 c.c. of distilled H_2O, boil again to coagulate precipitate. Then remove from hot plate, and when thoroughly cold, filter on a porcelain Gooch crucible or tarred filter paper, wash with cold H_2O and dry at 100°F. in air bath for about one hour, or until weight is constant. Weigh carefully.

Calculation

One Assay Gallon Taken—

Number of decigrams of silver chloride found X.75275
will equal ounces of metallic silver per gallon.
Note—.75275 is the factor required to convert silver chloride into metallic silver.

The above methods of analysis will not only help the plater to keep an accurate check on the metal contents of his solutions, but will also enable his employer to keep a record of the amount of precious metal he has on hand.

THE EASIEST WAY

An American soldier brought in a Hun prisoner recently and found the fellow had a pocket full of French money. The dough-boy looked at the money, the picture of fine restaurants in Paris loomed before him, and then, tapping the Hun on the shoulder, he said: "Kamerad, kannst du craps schutzen?"

*All rights reserved by New York Branch.

ELECTRO DEPOSITION OF BRIGHT NICKEL*

By Harvey Miller

In view of the various methods used to produce bright nickel deposits, and articles that have appeared on this subject, the advantage or disadvantage of the extremely bright deposit, or character of the deposit, and the use of such solutions for the deposition of same are not set forth. To explain the definite action of materials used in solutions which determine the bright deposit, would be a difficult undertaking; also it is not my object in view to outline any special formula of solution, as the most efficient for all purposes. I will explain my experience with bright nickel, and the method I use commercially, plating about 50,000 pieces daily; also some of the conditions in solutions with variable effects upon the deposit. Bright nickel is more suitable on a class of goods which require a plate of not more than medium thickness, due to certain characteristics of the bright deposit, being more or less brittle, and this will develop to a greater degree on a very heavy plate. A bright nickel deposit is superior in point of appearance and wearing qualities than the equivalent of a coarse grained deposit, which requires buffing to bring up the color, inasmuch as it presents a clean-cut finish, without any of the nickel being removed by buffing. A very extensive line of goods with ornamental designs are furnished in bright nickel and lightly buffed. Such articles plated with the ordinary nickel deposit would produce an unsatisfactory finish on parts which cannot be reached with the buff. The nature of materials which are used as addition agents to solutions, such as gelatine, glucose, gum and other organic substances, which are non-electrolytes, and the conditions produced by their presence in solutions, are calculated to prevent rather than promote the successful electro deposition of nickel. Salts of cadmium produce conditions in the solution similar in effect, and also a very bright deposit. Just what the definite action of the cadmium salts are is not clear, or as to whether they have any colloidal properties, cadmium chloride dissociates incompletely in solution; this might account for some colloidal action by hydrolysis, or there may be a reaction of the cadmium and ammonium. The resistance in solutions containing excessive amounts of these brightening agents, while deposition is taking place, might be described in a way like trying to sail a ship through a fog. In another sense, they create an element of disturbance interfering with good operating conditions. Decreasing the throwing or covering power, consequently parts with deep pockets or points of most resistance will receive a very light deposit, or possibly none at all, as the degree of resistance in the solution may be. These are extreme conditions, however, but they serve to illustrate the general principle of working conditions produced by the presence of these materials in solutions. On the other hand, by operating solutions with appropriate conditions, and by the moderate use of these materials very satisfactory results will be obtained. Experience has shown that some such colloids as stated above, or substances which act in effect as colloids, must be used

*All rights reserved by writer.

in solutions if very bright deposits are to be obtained. Under the circumstances, attention should be directed to the means of providing the most satisfactory conditions for operating solutions with these materials present. As we understand a deposit of high luster is a fine grained deposit. This is obtained by the use of materials which provide suitable conditions in the plating solution for reducing the crystal size of the depositing metal. The material held in suspension in the solution seems to act as a filter, or producing more or less resistance, the nickel depositing in finer particles. The tendency more or less of these conditions is to detract from the adhesive qualities and flexibility of the deposit. This should be taken into consideration when plating articles which require bending or very severe tests. Although I plate bright nickel on a class of goods such as name plates of antimonial lead, which require an inscription to be stamped or engraved on the nickel surface, which stands under the knife and stamp without raising the plate at the edge of the letter, which is quite a severe test. The nickel is plated one-half hour, and could stand a hard buffing, if necessary, without cutting through the plate. The composition of the solution, or combination of salts in solution, effecting the conductivity, metal content and acidity should be considered. A high metal content is not desirable for bright plating, as it tends to produce a more coarse grained deposit, due to the increased rate of deposition; also a high metal concentration frequently produces conditions at the cathode favorable to pitting, effecting more especially large, flat surfaces. Solutions should also have good conductivity, with a fair degree of acidity, to further promote favorable conditions. As previously stated, the brightening agents exert a decreasing influence on the conductivity of the solution as well as the character of the deposit. A higher voltage can be used without a burning effect. The use of good conducting salts, or the presence of these salts in the solution which increase the conductivity, will modify these conditions, and at the same time facilitate the deposition of nickel. The presence of a small amount of free acid in the solution will increase the effectiveness of the brightening agents. The most suitable proportion will depend to some extent on conditions, and the particular class of metal to be plated. The occasional small additions of HCl to my solutions produce beneficial results. As the acidity of the bath effects the cathode efficiency, also excessive evolution of hydrogen will result in a peeled deposit, it is not advisable to use much strong acid. Boric acid produces good results, with more permanency, and is the safest to use. The method of handling some classes of goods, or the use of racks for supporting the articles in the solution, produce conditions at the cathode, for plating this class of work, which contribute to the necessity of having solutions of good throwing or covering power to produce a uniform deposit on such articles plated in this manner. For example, I use iron racks with double rows of hooks for holding the antimonial lead parts of varying shapes and sizes; the capacity of each rack is from 60 to 120 pieces. About 50% of the surface faces the inner side of the rack. The solutions I use for plating this class of goods are composed

largely of $Ni\ SO_4\ (NH_4)_2,\ SO_4,\ 6H_2O,\ H_3B\ O_3$ and a rather large amount of Na Cl; also additions of $Ni\ Cl_2,\ 6H_2O$. The deposit from these solutions on this class of goods is of uniform thickness, and of good quality and color. I prefer to operate my solutions with a metal content of about 2 to 2¼ oz. of Ni per gallon. I find they have better throwing power than solutions heavier in metal. Some time ago I had occasion to use a solution of patented bright nickel-plating salts. The nickel deposit obtained from this solution was excellent as far as quality and color is concerned. Being interested to know the composition of this solution, I made an analysis of the mixture, which I found to be as follows: The material is essentially a mixture of $Ni\ SO_4,\ 7H_2O$ and $(NH_4)_2,\ SO_4$ in about the right proportion to form $Ni\ SO_4,\ (NH_4)_2,\ SO_4,\ 6H_2O$ in solution. The mixture did not contain any of the dry $Ni\ So_4,\ (NH_4)_2,\ SO_4,\ 6H_2O$, besides there is some H_3BO_3 and an excess of Na Cl; also some organic matter, as follows:

Nickel	9.75%	
Sulphate radical	31.90	(SO_4)
Chloride radical	13.74	(Cl)
Ammonium radical	6.05	(NH_4)
Boracic acid and organic matter.	8.75	

Corresponds to the following:

$Ni\ SO_4,\ 7H_2O$	46.66%
$(NH_4)_2,\ SO_4$	21.94
Na Cl	22.65
H_3BO_3	8.75
	100.00

and organic matter

As stated above, the deposit from this solution was of good quality, uniform and white. Theoretically, with a large amount of the alkali metals present in solution, the alkaline reaction at the cathode would tend to produce a darkening effect on the deposit. However, I obtained good results from solutions which contain these salts, although I prefer to use some $Ni\ Cl_2,\ 6H_2O$ in place of some of the Na Cl. Peeled deposits result from several different causes, the solution too concentrated, the acidity too great, or an excess of the brightening agent. The least amount of the brightening material that can be used to produce the desired result the better. With the solution slightly acid, or about one or two ounces of $H_3\ BO_3$ per gallon, and other conditions favorable, the minimum amount of this material can be used, making no further additions as long as it continues to plate bright, which should be about two or three weeks. Any of these brightening materials referred to above will produce the results. With reasonable care and judgment, and with due regard for the control of conditions, bright nickel solutions should run in good working condition indefinitely, as I have solutions working for about five years which produce fine white deposits, and as bright as when buffed.

ALKALI COPPER SOLUTION*

By Fred Haushalter

In every plating room that I ever have had charge of, I have had an alkali copper solution, but they were used only as a strike for iron or steel work before being plated with another metal. If I had any work that required a heavy deposit of copper, I always did it in an acid or duplex copper bath. My reason for doing this was: Whenever I attempted to do heavy copper plating in an alkali solution, no matter how careful I was in making my solution or cleaning my work, I always had blistering, streaking and everything else that was bad and would make me wish I had learned some other trade to make a living.

I might say that in the deposition of other metals, such as gold, silver, nickel and brass, I have always been successful.

When I accepted the position which I now hold I found I would have to improve in depositing a heavy coat of copper with an alkali solution. This firm does quite a lot of work in brass and nickel, but the largest part of their work is done in copper. In this place there were two copper solutions of 650 gal. each, and both solutions were absolutely useless for good work, and I believed it would be more economical to discard them and make new ones than to try to build up the old ones. How to make them was a puzzle, for while there are any number of formulas in the text books and trade journals that can be worked by experienced hands, I must have something better, for my help consisted of girls that had never been taught how to handle their work properly. So I therefore had to have a solution that would be as near fool-proof as it was possible to make it.

In looking over some of the "Reviews" that I have I was fortunate enough to read about a member of the American Electro-Platers' Society, who was honest enough to acknowledge he had all the trouble that a cyanide copper solution could give a man, and, more luck, he was a member of the same branch as myself. So to this member I went for information. He had overcome his troubles, so I explained to him the class of work I was doing and what the final finish had to be. He gave me a formula and I made a solution of 650 gal., making just a few small changes of my own which I thought would improve it.

My first batch of work came out a bright red copper; not one piece was blistered or streaked. This bath has now been working daily for the past five months to its full capacity, and in this time I have plated thousands of pieces of work: tin oil cans, funnels, disinfectors, measures from one quart to 5 gallon capacity; also iron and steel work, polished and unpolished, and up to the present time I have not had one piece either blister or streak. This is a rather broad statement to make and may be doubted by some, but I will extend an invitation to anyone who is a member of the American Electro-Platers' Society to visit my place and stay with me a day if they wish to see for themselves how this work is done.

*All rights reserved by New York Branch.

The formula for this bath is:

Sodium Cyanide	300 lbs.
Sodium Carbonate	30 lbs.
Sodium Bisulphite	10 lbs.
Sodium Hyposulphite	5 lbs.
Copper Carbonate	100 lbs.
Copper Cyanide	75 lbs.
Water.	650 gals.

I will now give directions as to how I made my solution. I filled my tank about three-quarters full of water. I then dissolved my cyanide, carbonate of soda, bisulphite of soda and hyposulphite of soda. Next came the carbonate of copper, and when this was all dissolved I added the copper cyanide and then enough water to make up 650 gal.

The only addition I make to this bath is about 40 lbs. of cyanide per week. Whenever the deposit gets dark I add about 2 lbs. hyposulphite of soda. I make this addition about twice a week.

This bath is worked at 3 volts and the temperature is from 120° to 160° Fahr.

And now, in concluding this paper, I wish to extend my thanks for the advise and help given me, and to give all credit for this work to my fellow member, Mr. Thos. B. Haddow.

Note—Mr. Haushalter is foreman-plater for William Vogel & Bro., Brooklyn, N. Y.

Are you interested in having a set of lantern slides for the use of our society? Photos of interesting plating subjects, chemical apparatus, mechanical apparatus, improved methods of all kinds, with notes describing the subject and its purpose. These could be used at the convention and then circulated among the branches. An offer to make the slides and write up the connecting story comes from F. J. Liscomb, if prints, on glossy paper, size 3x4 inches or under, or negatives, any size, are sent to him. They should contain no advertising matter.

Send prints or negatives direct to F. J. Liscomb, 6066 Nickerson Avenue, Chicago, Ill.

A request from the chairman of Educational Committee for Rochester Convention has been sent to all branches of our society. Do not pass it without taking some definite action. The convention should bring out the best papers of the year, not only for the opportunity of discussion, but it also gives the best of material for our "Monthly Review."

Technical and practical papers (if there is such a distinction) are the kind desired, as we believe we are beyond the point when our time should be taken on the subjects of "Our Society."

H. J. Richards has assumed the responsibility of producing results for St. Louis Branch. What are you or your branch doing?

ELECTRO DEPOSITION OF COPPER UPON WAX*

By Royal F. Clark

A brief outline of the processes through which a stamping matrix passes will give a more clear conception of the methods of operation that will be given.

The artist sings into a recorder and an impression of the sound waves are made upon a disc of specially prepared wax. This wax disc is given a thorough coating of silver and graphite to make the surface metallic, so that it will carry the electric current and receive a deposit of copper which is put on in a copper sulphate bath. After the deposited copper shell, which is called the Master matrix, is removed from the wax, trimmed and cleaned, it is backed up with a black stock:

BLACK STOCK

Rotten Stone,	Lampblack	Flock {Shoddy
Clay,	Pitch	}Cotton
Barytes (Barium)	Gumm Rosin	

and then coated with silver. The silver is treated with potassium iodide, which prevents the subsequent copper deposited from adhering. The second copper shell is the Mother matrix, and from this is made the Stamping matrix. The process of making the Stamping matrix is the same as that of the Mother. The Stamping matrix is nickel-plated so as to obtain more impressions than would be possible from copper.

The methods used and solutions employed, in general, are as follows:

GRAPHITE

Ceylon Graphite	1 lb.
Silver Nitrate	1 oz.
Distilled Water	1 pt.

These are well mixed together and heated in a porcelain dish over a water bath until dry. It is then transferred to a graphite crucible and brought to a red heat. After cooling it is sifted through a very fine wire sieve. It is then sifted through fine silk onto the wax disc. It is claimed that the nitrate of silver becomes metallic by this process and increases the conductivity of the graphite.

This graphite is dusted on the original wax record and carefully rubbed in by hand for five minutes with a fine camel's hair brush. The wax record is then placed in the graphiting machines and well brushed for ten more minutes. The wax comes out with the graphite highly polished. The loose graphite is carefully brushed off and the wax is then ready for electro-plating with copper.

THE COPPER SOLUTION PRIMARY BATH

Copper Sulphate	32	oz.
Sulphuric Acid	½	oz.
Distilled Water (to make)...	1	gal.

*All rights reserved by New York Branch.

The graphited wax record is wired for contact and then washed with:

½ Distilled water.
½ Denatured alcohol.

This is to thoroughly wet the surface before putting it into the plating bath. It is placed carefully in the copper sulphate solution and slowly agitated at first. The current should be on before putting the wax into the bath. A current of 8 amperes is used for 10 minutes. The wax is removed from the solution and carefully brushed with a camel's hair brush as it is returned to the bath. The current is increased to 12 amperes. At the end of 10 minutes it is again removed and brushed as it is returned to the bath. The current is increased to 14 amperes. This operation is repeated three more times and each time the current is increased 2 amperes. Care must be used so as to not to employ too much current and produce "gassing," which would tend to cause an imperfect reproduction. The object of brushing each time is to remove any loose particles that may develop on the face of the record. The record is run at from 20 to 24 amperes until the entire surface is covered with copper. This generally requires about 1½ hours.

The record is then transferred to the secondary bath.

SECONDARY BATH

Copper Sulphate	32 oz.
Sulphuric Acid	3 oz.
Distilled Water (to make).....	1 gal.

The record is run in this solution for 18 hours at a current of 24 amperes. The copper shell of a 10" record should weigh 16½ oz., a 12" record, 18½ oz. This reproduction is called the Master matrix. When the required amount of copper is deposited the record is removed from the bath and the copper separated from the wax. Care must be used not to scratch the face of the copper shell. The rough edges of the copper are trimmed and the back smoothed and it is then backed up with Black Stock and mounted on a suitable holder to be replated with copper to obtain the reverse, or Mother matrix.

The surface of the stamping shells are thoroughly cleaned. A cold solution of a causticized ash can be used.

CLEANING SOLUTION

Causticized Ash	4 oz.
Water.	1 gal.

The causticized ash solution is applied with a soft tampico hand brush. The shell is thoroughly rinsed in cold water, dipped into a weak solution of sodium cyanide and then given a coating of silver.

SILVER SOLUTION

A.	Silver Nitrate	1½ lbs.
	Distilled Water	7½ qts.
B.	Sodium Chloride	5 lbs.
	Distilled Water	7½ qts.

Mix A and B together. The silver is precipitated as silver chloride. It is washed free from all soluble salts.

C. Sodium Cyanide ..... 2¾ lbs.
Distilled Water .....12 qts.

When the sodium cyanide is all dissolved in the water the solution "C" is added to the silver chloride "A" plus "B," gradually, while stirring vigorously. The resultant solution is filtered.

Whiting—finely divided calcium carbonate—is added until a thin, creamy paste is obtained. This is then ready for use.

The silver paste is rubbed over the copper disc until it has a clear coating of metallic silver. It is then washed with distilled water and dipped into a solution of tincture of iodine—an alcoholic solution of potassium iodide.

IODIDE SOLUTION

Tincture of Iodine ..... 4 oz.
Distilled Water ..... 5 gals.

This solution is readily affected by strong light and should be kept from direct sunlight. A new solution should be made twice each day.

This operation converts part of the silver coating to silver iodide and prevents the subsequent coating of copper from adhering to the Master matrix.

Care should be used not to expose the silver iodide film to strong light, and as soon as possible after this operation the matrix should be placed in the copper sulphate solution, the current should be on. After the Master matrix is dipped into the iodide solution it is rinsed with cold water and then put into the primary copper sulphate bath for Mother matrix.

(To be concluded in May Number)

PRELIMINARY ANNOUNCEMENT

The eighth National Convention of the American Electro-Platers' Society will be held at the Hotel Seneca, Rochester, N. Y., on June 30, July 1, 2, 3, 1920.

A strong educational program has been arranged, the list of speakers includes authorities of wide reputation. All members of the society should plan to attend and should exert their best efforts to get their Superintendents and other officials of their concerns to attend also.

The Rochester Branch is exerting every effort to make this the best convention, from every point of view, that the society has ever held. An unusual program for entertainment has been arranged for visitors.

Special provision for women visitors is being made by the Ladies' Auxiliary of the Rochester Branch. Bring the ladies with you.

A later announcement will give full details of the program. But plan now to attend. For Rochester will not only make the conven-

tion decidedly worthwhile, from the practical standpoint, but also to show you the time of your life.

The Committee on Hotels, has requested of me to ask you to also give space to the rates of the different hotels in Rochester, and those planning to attend the convention should make reservation now. The principal hotels and their rates are as follows:

Hotel Seneca, A. E. S. Headquarters—Room rates:

	1 person per day	2 persons per day
Rooms with running hot and cold water	$2.50	$3.50
Rooms with large bed and shower bath	2.75	4.00
Rooms with large bed and shower bath	3.00	4.50
Rooms with large bed and tub bath	3.00—4.00	4.50—6.00
Rooms with twin beds and shower bath		5.00
Rooms with twin beds and tub bath		7.00

Hotel Powers—Room rates:

Rooms with running hot and cold water	2.00	3 00
Rooms with shower bath	2.50—3.00	3.50—6.00
Rooms with tub bath	2.75—4.00	4.00—7.00

Hotel Rochester—Room rates:

Rooms with shower bath	3.00	5.00
Rooms with tub bath	3.50—4 00	6.00

Hotel Hayward—Room rates:

Rooms with running water	2.00—2.50	3.50
Rooms with bath	2.50—3.00	3.50—4.00

Whitcomb House—Room rates:

Rooms	2.00—3.00	3.00—4.00
Rooms with bath		4.00—5.00

Hotel Eggleston—Room rates:

Rooms	1.50	2.50
Rooms with bath	2 00	3.50

The society as a whole earnestly hopes that every member of each of the branches will make a supreme effort to attend the convention.

Mr. S. P. Gartland, Secretary of Rochester Branch requests of the secretaries of the different branches that they send to him a complete list of their membership together with the names of those selected by their branches to act as delegates and alternates.

Yours very truly,

H. C. BERNARD,
Chairman: Program and Publicity

WHAT THE BRANCHES ARE DOING

New York

New York Branch of the American Electro-Platers' Society meets every second and fourth Friday of each month at 32 Union Square, New York, N. Y. Secretary, John Burke, 110 Glen St., Brooklyn, N. Y.

March meetings of the New York Branch were well attended. President Sterling presided. Five applications for active membership were received and referred to the Board of Trustees.

The main topics under discussion were: Brass, Bronze, Galvano and Platinum Hydrate Solutions.

Mr. John Burke exhibited a sample of iron chain bright brass plated in the following solution:

Copper carbonate 5 ozs., zinc carbonate 1 oz., sodium cyanide 12 ozs., carbonate of sodium 4 ozs, salamoniac ¾ oz., bisulphide of sodium 4 ozs., rochelle salts 4 ozs., water one gallon. Mr. Burke states he uses no free cyanide in this solution, the rochelle salts is the magic fluid that eliminates the necessity of free cyanide, arsenic dissolved in caustic soda is the brightening agent used, 2 tablespoonsfull every two weeks added to a 400-gallon solution the brass deposit from this solution will acid dip bright.

Mr. Steward asked a question: Why is the finish of a diamond effected by a hot platinum hydrate solution?

Mr. Shaw exhibited galvanoplastic samples which were admired and pronounced perfect. A copper sulphate solution was employed with 6 ozs. of free sulphuric acid per gallon. The samples had a 60 hour deposit at 1 volt pressure.

Mr. Wilson exhibited two pieces of sheet steel, one piece being a little heavier than the other, but made from the same material. When copper-plated one would plate bright, the other dull, the same plating conditions were employed for both samples, examination showed one piece had a very light scale. Pickeling was recommended to overcome the dull deposit of copper. Immersing scaled steel into a bright acid dip with the addition of muratic acid to the dip was also recommended.

The following should have appeared in the February issue:

Mr. Steward read a paper dwelling on hydrogen penetration of iron and steel, during zinc-plating and the extraction of the hydrogen from the zinc-plated iron and steel with the aid of heat.

Experiments proved that if articles are baked at 500°F. all hydrogen is expelled and the iron or steel's original properties are restored. In discussing zinc-plating the following were recommended as suitable additional agents for the purpose of thoroughing zinc deposit into deep crevices: zinc chloride, sodium chloride, ammonium chloride and sodium acetate. Extractions of carbonates from silver solutions were also discussed. A 20% solution of barium cyanide was recommended for this purpose.

Milwaukee

Meets first Friday of each month at West Side Bank Building. Secretary, A. W. Ruttan, 1105 *Twenty-eighth St., Milwaukee, Wis.*

At our April meeting two applications for active membership were received.

The attendance for the last six months has been eighty per cent, or better, and we all take off our hats to the Grand Old Man of the Milwaukee Branch, Librarian Daniel Wittig, for the enthusiasm displayed at the meetings. Dan (as we all call him), is a regular attendant at all of the meetings, and when the question-box is brought out, if there are no questions in it, Dan will entice some of the members to ask questions. And the answers are all good and instructive.

One of our members has occasion to use a quantity of boric acid. He had been getting it in powdered form, but that being impossible to secure, he bought the crystals, and it takes about four times as much, by weight, of the crystals as it does of the powdered, to get the same results. He could not find the formula, so we will have both kinds analyzed at a special meeting to be held at the Armour & Thorenson laboratories. This meeting to be called for the purpose of forming a class in electro-chemistry.

Mr. John Guttman, plater of the Paramount Phonograph Co. invited the members to inspect their plant, and promised us refreshments when we called. Mr. Guttman spoke of having something guaranteed to be 110-proof. The writer does not know whether he means the copper or nickel solutions, or something he had stored away. And to show that his heart was in the right place, furnished the lunch for the April meeting by digging into his pocket and fishing out some fresh roasted, southern grown peanuts. Hope to meet all the boys at Rochester.

Cincinnati

Meets on the first and third Friday of each month at Dennison Hotel. Secretary, W. J. Husing, 729 McMakin Ave., Cincinnati, O

Mr. Walter Goodwin of Marietta, Ohio was elected to active membership at the meeting held on April 2nd. Every meeting has had some interesting discussion, and at some future time we will have something for the "Monthly Review."

Cleveland

The Cleveland Branch meets every second and last Saturday of the month at 1344 *East Prospect St. Secretary B. F. McCormick,* 1941 *West 77th St.*

We are getting where we believe the "Review" readers will soon hear from us, the pep shown by Detroit and Chicago branches will stir up our members. Mr. A. Nordbloom, formerly of Syracuse Branch, has transferred to our branch, and one new member was elected. We have also received an application from Mr. Alfred M. Finn, who was associated with Dr. Blum of the Bureau of Standards in research work.

Chicago

Meets second Saturday of each month, 8 p. m., at the Briggs House, Randolph and Wells Sts. Secretary, C. E. Thornton, 948 Leclaire Ave., Chicago, Ill.

Our last regular meeting held April 10th was fairly well attended, and was as usual very interesting.

The question of papers for the convention was discussed and the prospects are that we will furnish our share of papers as several of the members expressed their willingness to do their bit in the way of writing papers, so it is safe to say that Chicago Branch will be heard from.

The Library Committee reported progress, and they were instructed to continue their efforts and report at the next meeting.

The following questions were asked and discussed:

Question No. 1—My nickel solution is plating brittle. In plating soft brass castings they sometimes nick together, this causes them to peel. What is the remedy?

Answer—This condition sometimes happens by not rinsing the work properly from the cyanide dip, carrying some of the cyanide into the nickel solution. It also happens by cleaning the work properly, and there is also a possibility that the solution is too acid.

Question No. 2—About how many volts and amperes are needed for an electric cleaner?

Answer—This depends on the area of the surface that is to be cleaned, and the kind of solution that is used for cleaning. A cleaning solution with high percentage of carbonate requires higher voltage to force the required amount of amperes than a solution that is high in caustic soda or cyanide.

Question No. 3—Can small die castings be nickel-plated in a mechanical plating barrel?

Answer—There is no definite method for nickel-plating die castings in a mechanical plating barrel, but it was suggested that after cleaning, the castings be immersed in a hot cyanide copper solution until a deposit of copper was obtained by immersion, and then plated in the mechanical plater.

Detroit

Meets first Friday in each month at Cass Technical High School, Platers' Classroom, 2nd Avenue and Beech Street, at 8 p. m. Secretary, E. G. Lovering, 562a Grand River Avenue, Detroit, Mich.

Owing to the Cass School being closed Good Friday, our regular monthly meeting was held Wednesday, April 7th.

President Fritz opened a well attended meeting, even our old pal, Benny Miller was with us again, and studious Fred Harig, who is putting in five nights a week at the Cass School, where he is keeping the Professors busy, relieving them of their knowledge, found time to skip away and attend the meeting. He promised to write a paper for the Rochester convention. More power to you Fritz! Owing to Detroit's successful number of the Review, we received a large amount of communications which were read and disposed of in the proper manner. Discussion of the branch in regard to the

Secretary complying to the request of Dr. Blum, in regard to raising funds through the manufacturers of Detroit. General discussion of plating die cast metal, in an answer to an inquiry from Toledo, brought forth the following mode of procedure by one of the new members:

Cleaning Solution:

Sal. Soda	2 lb.
Rosin	¼ oz.
Water	1 gal.

Nickel Strike:

Double Nickel Salt	1 lb.
Sal Ammoniac	2 oz.
Epsom Salts	4 oz.

Nickel Solution:

Double Nickel Salt	1 lb.
Sal Ammoniac	1½ oz.
Epsom Salts	2 oz.

The die castings are cleaned in the above cleaner, then given a copper strike, then in the nickel strike, which must be kept neutral, then in the nickel bath.

Aluminum die castings are cleaned in the same cleaner, rinsed in water, then run through an iron chloride dip, then into the nickel strike and nickel bath.

Mr. Ream, one of our Flint members, claims that by heating his nickel solutions every Monday morning to the boiling point, he drives out all the "dissolved air," letting it cool before working, he has very little trouble with pitting. "Open for discussion by the other branches."

It takes Detroit Branch to dig up the new stuff—"Get busy Chicago."

St. Louis

Meets third Saturday of each month at Barr Branch Library, corner Jefferson and Lafayette. Secretary, H. H. Williams, 4156 Botanical Ave., St. Louis, Mo.

At a well attended meeting held April 17th, we elected three applicants into membership, took care of routine business in short order, and then George got busy. Lovering's "Magic Fluid" came in for its share, and the results have been varied, as it seems that no one followed instructions faithfully. Frank Rushton, who recently took unto himself a wife, and on his wedding trip visited our Wichita "live wire," E. W. Heil, brought back greetings, which we appreciated, even if they were not in a bon-bon dish; whether sugar is too high in Kansas, or whether he did not care to take a chance on delivery under the circumstances, we do not know.

Every member of our branch extends best wishes to Frank, who says he has just found out what he has been missing for years. He leaves shortly for Mexico City to install and operate a plating plant.

On account of Pittsburg being some distance away, and he being in St. Louis, we had some trouble in consoling the Vice-President of that branch at not being able to attend their first banquet on this evening, but we were glad to have Louis Schulte with us.

Toronto

Meets second Thursday of each month at Occident Hall, Bathurst and Queen Streets. Secretary, Oswald Holtham, 245 University Ave., Toronto, Ont.

The regular meeting of Toronto Branch held March 11th, was called to order by President Magill.

Albert William Picton was elected a member of Toronto Branch.

Questions submitted were:

What is a good dip for producing a satin finish on aluminum?

A member stated he had good results from a caustic soda dip and running through a dilute nitric acid solution to remove any black substance there may be on the work.

Agitation was again discussed and many good points were brought out.

Mr. Magill informed us that he will be able to let us know of the results of an apparatus which he is having installed on some of his vats for filtering his solutions which are also mechanically agitated.

Lovering's "Magic Fluid" article was read and a lengthy discussion followed.

All the members present were of one mind on the point that this article is most interesting and one of the best they had heard for some time.

The next regular meeting was held April 8th.

There was a good attendance.

An application for membership was received from Mr. G. M. Burns of Montreal.

Vice-President O'Keefe reported the progress and success of the Electro-Platers' class at the Toronto Technical School during the past term. He also stated that the next term would be more successful if more of the members attended the classes.

A presentation was made to Dr. Mackie by the members attending the classes showing their appreciation of his services rendered them during the past term.

The suggestion of receiving Dr. Mackie as an honorary member into Toronto Branch, was received with great favor.

The question box contained the following:

1. Would an electric cleaner prove more efficient if operated at 10 volts, than if operated at 5 volts?

General opinion was that the 10 volts would be more efficient, but that this would be governed by several other conditions.

2. How can I obtain a simple, but practical gun metal finish on steel articles, such as cigarette cases and mesh bags?

The simplest and best method given was to black nickel-plate them.

3. In plating aluminum a method used was to dip the aluminum in perchloride of iron solution. The question arose whether iron in a nickel solution was a detriment?

The opinion of the members was that the small amount of iron which got into solution would do little harm.

APPLICATIONS FOR MEMBERSHIP

Cleveland

Alfred M. Finn (associate).....1878 E. 59th St., Cleveland, O.

Milwaukee

Oscar Hintze (active).....90—2nd St., Milwaukee, Wis.

Indianapolis

Harry Maze.....312 East North St., Indianapolis, Ind.

Toronto

G. M. Burns.....Montreal, Que.

ELECTED TO MEMBERSHIP

New York

Geo. Stephanson (active).....29a Lorimer St., Brooklyn, N. Y.
Miss Jessie L. Minor (associate).....Garfield, N. J.
Joseph Orr (active).....80 Fairview Ave., Chicopee, Mass.
August L. Medel (active).....30 Milton Ave., Jersey City, N. J.

Chicago

Ovide J. Bedard (active)....care of Allith-Prouty Co., Danville, Ill.
Edward L. Fortman (associate)...3348 N. Paulina St., Chicago, Ill.

Cleveland

Philip Seubert (active).....4405 Irene St., Cleveland, O.

Cincinnati

Walter Goodwin (active).....107 N. 3rd St., Marietta, O.

St. Louis

John J. Spindler (active)....1621 E. Columbia St., Evansville, Ind.
Chas. R. Sebastian (active)....2927 Wisconsin Ave., St. Louis, Mo.
Fred N. Weber (active).....5439 Odell St., St. Louis, Mo.

Toronto

Albert W. Picton (active)....110 Sherbrooke West, Montreal, Que.

TRANSFER

A. Nordbloom from Syracuse Branch to Cleveland Branch.

If I speak a good word of cheer to one
  Whose sorrows have borne him down,
And give him new hope to journey on,
  And change to a smile his frown,
I shall not dread when the shadows fall
  And the end of life draws near,
For that wondrous love that shelters all
  Will drive away my fear.

For my life is measured by what I mete,
  And I earn my own reward,
So the love I give makes my heart complete,
  And through it I gain the award.
For whether I dwell in a house by the road,
  Or far from the haunts of men,
If only my love makes bright the abode,
  No fear shall enter it then.